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Original Research

Evaluation Of Cardiac Issues In Infants And Children Undergoing Surgeries In General Anaesthesia

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Abstract
Objective: This retrospective study aims to evaluate the prevalence, risk factors, and clinical implications of cardiac issues in infants and children undergoing surgeries under general anaesthesia.
Methods: Medical records of 500 pediatric patients (aged 0-18 years) undergoing surgeries under general anaesthesia between January 2022 and December 2023 were retrospectively reviewed. Data on patient demographics, surgical characteristics, anaesthetic management, and postoperative cardiac complications were collected and analyzed. Multivariate logistic regression analysis was performed to identify independent predictors of cardiac events.
Results: Among the study cohort, 15% of pediatric patients experienced postoperative cardiac complications, with arrhythmias being the most common (8%), followed by myocardial ischemia (5%) and hemodynamic instability (2%). Age less than one year, complex surgeries, and pre-existing cardiac conditions emerged as significant predictors of cardiac complications ($p < 0.05$). Tables summarizing demographic characteristics, surgical profiles, incidence of cardiac complications, and predictors of cardiac events are provided.
Conclusion: Our findings highlight the significant burden of postoperative cardiac complications in pediatric surgical patients and underscore the importance of tailored perioperative management strategies. Early identification of high-risk patients and multidisciplinary collaboration are essential for optimizing perioperative cardiac care and improving outcomes in this vulnerable population.
Keywords: Cardiac issues, infants, children, surgeries, general anaesthesia

Introduction:
Cardiac complications in pediatric patients undergoing surgical procedures present a significant clinical challenge, necessitating a nuanced understanding of their etiology, prevalence, and management strategies. While surgical interventions are often essential for treating congenital anomalies, trauma, and other pediatric conditions, the administration of general anaesthesia introduces complex physiological changes that can profoundly impact the cardiovascular system. Despite advancements in perioperative care and anaesthetic techniques, cardiac events remain a concerning postoperative complication in this vulnerable population [1-5].
The vulnerability of infants and children to cardiac issues during surgery stems from various factors, including their immature cardiovascular systems, limited compensatory mechanisms, and unique responses to anaesthetic agents. Compared to adults, pediatric patients exhibit heightened sensitivity to alterations in preload, afterload, and myocardial contractility, which can predispose them to hemodynamic instability and arrhythmias during the perioperative period. Additionally, the presence of congenital heart defects, acquired cardiac conditions, or comorbidities further complicates the perioperative management of these patients, increasing their susceptibility to adverse cardiac events [6-10].

This paper seeks to address the gaps in our understanding of cardiac issues in pediatric surgical patients by examining the prevalence, risk factors, and clinical implications of postoperative cardiac complications. By analyzing a large cohort of pediatric patients undergoing surgeries under general anaesthesia, we aim to elucidate the epidemiology of cardiac events and identify modifiable factors that may influence their occurrence. Understanding the interplay between patient demographics, surgical characteristics, and anaesthetic management is paramount for developing targeted interventions to optimize perioperative cardiac care and improve patient outcomes [4-9].

Through a comprehensive review of the literature and analysis of our research findings, we endeavor to provide insights into the pathophysiology of cardiac complications in pediatric surgical patients and propose evidence-based strategies for mitigating perioperative risk. By highlighting the importance of tailored anaesthetic protocols, vigilant cardiac monitoring, and multidisciplinary collaboration, this study aims to enhance the safety and efficacy of pediatric surgical care, ultimately improving the quality of life for pediatric patients undergoing surgical interventions.

Materials and Methods:

Study Design: This retrospective observational study was conducted to evaluate cardiac issues in pediatric patients undergoing surgeries under general anaesthesia. The study protocol was approved by the institutional review board, and the need for informed consent was waived due to the retrospective nature of the analysis.

Study Population: Medical records of pediatric patients (aged 0-18 years) who underwent surgical procedures under general anaesthesia at our institution between January 2022 and December 2023 were retrospectively reviewed. Patients with incomplete or missing medical records were excluded from the analysis.

Data Collection: Data on patient demographics, including age, sex, and pre-existing medical conditions, were extracted from electronic medical records. Surgical variables, such as type of procedure, duration of surgery, and intraoperative events, were recorded. Anaesthetic management details, including choice of anaesthetic agents, airway management techniques, and perioperative monitoring modalities, were also documented.

Outcome Measures: The primary outcome of interest was the incidence of postoperative cardiac complications, including arrhythmias, myocardial ischemia, and hemodynamic instability. Cardiac events were identified based on documented clinical diagnoses, electrocardiographic findings, echocardiographic assessments, and hemodynamic parameters recorded during the perioperative period.

Statistical Analysis: Descriptive statistics were used to summarize patient demographics, surgical characteristics, and incidence of cardiac complications. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation or median (interquartile range), as appropriate. Chi-square tests or Fisher's exact tests were employed to assess associations between categorical variables, while Student's t-tests or Mann-Whitney U tests were used for continuous variables, as applicable. Multivariate logistic regression analysis was performed to identify independent predictors of postoperative cardiac complications, adjusting for potential confounding variables.

Ethical Considerations: This study was conducted in accordance with the principles outlined in the Declaration of Helsinki and the ethical standards of our institution. Patient confidentiality was strictly maintained throughout the study, and data were anonymized to ensure privacy.

Results:

Among the 500 pediatric patients included in the study, the mean age was 6.2 ± 3.4 years, with a slight male predominance (55%). Table 1 summarizes the demographic characteristics of the study population. Table 1 provides an overview of the demographic characteristics of the study population. The mean age of the pediatric patients included in the study was 6.2 years, with a standard deviation of 3.4 years, indicating a relatively young cohort. In terms of gender distribution, there was a slight male predominance, with 55% of the patients being male and 45% female.

Table 2 delineates the surgical characteristics of the study cohort, highlighting the frequency of various surgical procedures performed. Appendectomy emerged as the most common surgical procedure, accounting for 24% of cases, followed by tonsillectomy and adenoidectomy (18%) and hernia repair (16%). These findings reflect the diverse spectrum of surgical interventions encountered in pediatric patients undergoing procedures under general anaesthesia.

Table 3 delves into the incidence of postoperative cardiac complications observed in the study population. Among the 500 pediatric patients, 15% experienced cardiac issues following surgery. Arrhythmias were the most prevalent cardiac complication, occurring in 8% of cases, followed by myocardial ischemia (5%) and hemodynamic instability (2%). These findings underscore the importance of vigilant cardiac monitoring and tailored perioperative management to mitigate the risk of cardiac events in pediatric surgical patients.

Table 4 presents the results of multivariate logistic regression analysis, identifying independent predictors of postoperative cardiac complications. Age less than one year emerged as a significant risk factor, with patients in this age group exhibiting a 2.5-fold increased odds of experiencing cardiac issues compared to older children.

Complex surgeries also conferred a threefold higher risk of cardiac complications, emphasizing the importance of procedural complexity in influencing perioperative outcomes. Furthermore, pediatric patients with pre-existing cardiac conditions demonstrated a 4.2-fold higher odds of experiencing postoperative cardiac complications, underscoring the need for tailored anaesthetic management and close monitoring in this high-risk subgroup.

Table 1: Demographic Characteristics of Study Population

Variable	Value
Age (years)	6.2 ± 3.4
Sex (Male/Female)	275/225

Table 2: Surgical Characteristics of Study Population

Surgical Procedure	Frequency (n)	Percentage (%)
Appendectomy	120	24
Tonsillectomy & Adenoidectomy	90	18
Hernia Repair	80	16

Table 3: Incidence of Cardiac Complications

Cardiac Complication	Frequency (n)	Percentage (%)
Arrhythmias	40	8
Myocardial Ischemia	25	5
Hemodynamic Instability	10	2

Table 4: Independent Predictors of Postoperative Cardiac Complications

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)
Age < 1 year	2.5	1.2-4.8
Complex surgeries	3.1	1.5-6.2
Pre-existing cardiac conditions	4.2	2.0-8.9

Discussion:

The findings of this study underscore the complexity of managing cardiac issues in pediatric patients undergoing surgery under general anaesthesia. Our results reveal a notable incidence of postoperative cardiac complications, with arrhythmias being the most common, followed by myocardial ischemia and hemodynamic instability. These findings are consistent with previous research highlighting the vulnerability of pediatric patients to perioperative cardiac events and the need for tailored perioperative management strategies to mitigate risk. Age emerged as a significant predictor of postoperative cardiac complications, with infants less than one year old exhibiting a higher risk compared to older children. This observation is consistent with the physiological immaturity of the cardiovascular system in infants, who may have limited compensatory mechanisms and increased susceptibility to hemodynamic instability under anaesthesia. Therefore, special attention should be paid to this age group during perioperative care, with emphasis on meticulous monitoring and judicious use of anaesthetic agents to minimize adverse cardiac outcomes [6,9,10].

Complex surgeries were also identified as a significant risk factor for postoperative cardiac complications. This association may be attributed to the prolonged duration of surgery, increased intraoperative hemodynamic stress, and higher likelihood of intraoperative blood loss, all of which can exacerbate the cardiovascular workload and predispose patients to cardiac events. Therefore, meticulous surgical planning, optimization of intraoperative conditions, and close collaboration between surgical and anaesthesia teams are paramount for ensuring optimal outcomes in complex pediatric surgical cases [11-14].

Furthermore, pre-existing cardiac conditions emerged as a strong predictor of postoperative cardiac complications in our study. Pediatric patients with congenital heart defects or acquired cardiac diseases represent a particularly vulnerable subgroup, requiring specialized perioperative management tailored to their unique cardiac physiology. Close preoperative assessment, optimization of cardiac function, and coordinated care involving pediatric cardiologists are essential for minimizing perioperative risk and optimizing outcomes in these patients [13-15].

Comparison with existing literature highlights the multifactorial nature of perioperative cardiac risk in pediatric surgical patients. While our study confirms previous findings regarding the impact of age, surgical complexity, and pre-existing cardiac conditions on cardiac outcomes, it also underscores the need for ongoing research to refine risk stratification models and optimize perioperative protocols. Future studies should explore novel interventions, such as perioperative hemodynamic monitoring modalities and pharmacological strategies, aimed at reducing cardiac morbidity and improving long-term outcomes in pediatric surgical patients [11-15].

Conclusion

In conclusion, this study contributes valuable insights into the prevalence, risk factors, and clinical implications of cardiac issues in infants and children undergoing surgeries under general anaesthesia. By elucidating the predictors of postoperative cardiac complications and delineating evidence-based perioperative management strategies, this research aims to enhance the safety and efficacy of pediatric surgical care, ultimately improving outcomes for this vulnerable patient population.

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